Remarks

The Office Action mailed August 4, 2004, has been carefully reviewed and the foregoing is made in consequence thereof.

Claims 15, 17, 18, and 20-22 are now pending in this application. Claims 15, 17, 18, 21 and 22 stand rejected. Claims 19 and 20 stand objected to. Claims 1-14, 16 and 19 are canceled.

The rejection of Claims 15, 17, 18, and 21-22 under 35 U.S.C. § 103 as being unpatentable over Hager et al. (U. S. Patent No. 6, 362,776) in view of Hager et al. (U. S. Patent No. 6, 025,800) and Mo et al. (U.S. Patent No. 6,296,612) is respectfully traversed.

Hager et al. ('776) describe a radar altimeter 8 which includes three channels--phase ambiguity channel 9A, phase A channel 9B and phase B channel 9C each including an antenna 10, a receiver 34, and a digitizer 18. Receivers 34 each include a low noise amplifier (LNA) 12, mixer 14, and intermediate frequency (IF) amplifier 16. Transmit/receive switch 11 in channel 9C allows channel 9C to operate in either a transmit mode or a receive mode. Radar altimeter 8 further includes RF oscillator 20, clock generator 26, transmitter 32, digital signal processor (DSP) 30 and computer 33. Transmitter 32 includes power amplifier 21, modulator 22, single side band (SSB) mixer 24 and intermediate frequency (IF) offset generator 28. RF oscillator 20 is coupled to mixers 14A-14C and SSB mixer 24. Clock generator 26 is coupled to digitizers 18A-18C and IF offset generator 28. Radar altimeter 8 provides cross-track and vertical distance to the highest object below the air vehicle in, for example, ten foot wide down-track swaths, which are bounded by an antenna pattern that is approximately 46 degrees wide in the cross-track direction. (Column 2, line 47 to Column 3, line 8).

Hager et al. ('800) describes an interferometric radar altimeter utilizing a Doppler filter and a range gate. At Column 5, lines 1-15, Hager et al. describe an I/Q mixer which converts samples of a radar return to a baseband frequency and provides in-phase and quadrature phase

outputs to a digitizer for positive and negative Doppler frequency determination. Once the return from the I/Q mixer 46 is digitized by a digitizer 46, the Doppler filter 94 of the processor 48 is set to pass only the desired Doppler swath as determined from the vertical velocity provided by the vehicle's internal navigation system.

Mo et al. describe a digital real-time ultrasonic imaging system having a spectral Doppler imaging mode. An ultrasound transducer array 2 is activated by a transmitter of a beamformer 4 to transmit ultrasound beams focused at a desired transmit focal position. The transmitter provides a transmit ultrasound burst which is fired repeatedly at a pulse repetition frequency (PRF). The return RF signals are detected by the transducer elements and then formed into a receive beam by a receiver of beamformer 4. For a digital system, the summed (beamformed) RF signal from each firing is demodulated by demodulator 6 into its in-phase and quadrature (I/Q) components. The I/Q components are integrated (summed) over a specific time interval and then sampled by a "sum and dump" block 8. The summing interval and transmit burst length together define the length of the sample volume as specified by the user. The "sum and dump" operation effectively yields the Doppler signal backscattered from the sample volume. The Doppler signal is passed through a wall filter 10 which rejects any clutter in the signal corresponding to stationary or very slow-moving tissue. The filtered output is then fed into a spectrum analyzer 12, which typically takes the Fast Fourier Transform (FFT) over a moving time window of 64 to 256 samples. The I and Q components of the Doppler signal are filtered separately by identical wall filters, implemented as either FIR or IIR filters. (Infinite impulse response) IIR filters are generally considered more advantageous because of the large filter length required of an FIR implementation. In conventional spectral Doppler systems, an IIR high-pass filter is usually used, and it is often implemented as a cascade of three or four second-order stages. (Column 3, lines 3-42).

Claim 15 recites a method for processing radar return data in order to reject returns from a negative doppler shift swath to mitigate corruption of returns from a positive doppler shift swath, the radar receiving returns at each of a right channel, a left channel, and an ambiguous

channel. The method comprises "converting the radar data samples into in-phase and quadrature components," "separately filtering the in-phase and quadrature doppler frequency signals with band pass filters centered at the doppler frequency," "subtracting the quadrature components of the filtered doppler frequency signals from in-phase components of the filtered doppler frequency signals" and "determining phase relationships between the right, left, and ambiguous channels using the filtered in-phase and quadrature doppler frequency signal components, the quadrature components subtracted from the in-phase components."

Hager et al. ('776) in view of Hager et al. ('800) and Mo et al. do not describe nor suggest a method for processing radar return data to reject returns from a negative Doppler shift swath to mitigate corruption of returns from a positive Doppler shift swath. In addition, Hager et al. ('776) in view of Hager et al. ('800) and Mo et al. do not describe nor suggest a method which includes subtracting the quadrature components from in-phase components of filtered doppler frequency signals and determining phase relationships between radar return channels based on filtered and subtracted doppler frequency signals. For the reasons set forth above, Claim 15 is submitted to be patentable over Hager et al. ('776) in view of Hager et al. ('800) and Mo et al.

Claims 17 and 18 depend, directly or indirectly, from independent Claim 15. When the recitations of Claims 17 and 18 are considered in combination with the recitations of Claim 15, Applicants submit that dependent Claims 17 and 18 likewise are patentable over Hager et al. ('776) in view of Hager et al. ('800) and Mo et al.

Claim 21 recites a radar signal processing circuit that comprises "a mixer configured to generate a quadrature component of the CW signal using a sample delay element and further configured to down sample an in-phase component and the quadrature component of the CW signal to a doppler frequency, said mixer comprising at least one all pass filter and configured to subtract the filtered and down sampled quadrature component from the filtered and down sampled in-phase component" and "a band pass filter centered on the doppler frequency."

Hager et al. ('776) in view of Hager et al. ('800) and Mo et al. do not describe nor suggest a radar signal processing circuit which includes a mixer incorporating a subtraction element configured to subtract a quadrature component from an in-phase component after filtering and sampling down of the components to a doppler frequency. For the reasons set forth above, Claim 21 is submitted to be patentable over Hager et al. ('776) in view of Hager et al. ('800) and Mo et al.

Claim 22 depends from independent Claim 21. When the recitations of Claim 22are considered in combination with the recitations of Claim 21, Applicants submit that dependent Claim 22 likewise is patentable over Hager et al. ('776) in view of Hager et al. ('800) and Mo et al.

For the reasons set forth above, Applicants respectfully request that the Section 103 rejection of Claims 15, 17, 18, and 21-22 be withdrawn.

The objection to Claims 19 and 20 is respectfully traversed. Claim 19 is canceled and Claim 20 depends from independent Claim 15 which is herein submitted to be patentable. For the reasons set forth above, Applicants request that the objection to Claims 19 and 20 be withdrawn.

In view of the foregoing amendments and remarks, all the claims now active in this application are believed to be in condition for allowance. Reconsideration and favorable action is respectfully solicited.

Respectfully Submitted,

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